AIR QUALITY TECHNICAL REPORT

Anaconda Nevada Moly Project

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Support Document for the
Draft Environmental Impact Statement
Anaconda Nevada Moly Project

Lead Agency

U.S. Department of the Interior
Bureau of Land Management
Nevada State Office
P. O. Box 12000
Reno, Nevada 89520

Prepared by

ENVIRONMENTAL RESEARCH & TECHNOLOGY, INC.
FORT COLLINS, COLORADO

PREFACE

The Anaconda Copper Company of Denver, Colorado, plans to develop an open pit molybdenum mine and flotation mill plant on privately owned land and public land on which the company has located mining claims under the general mining laws, approximately 18 miles north of the town of Tonopah, located in Nye County, Nevada. In order to supply power to the Anaconda project, Sierra Pacific Power Company of Reno, Nevada, has filed with the U.S. Bureau of Land Management (BLM) an application for a right-of-way to construct and operate a 230kV electric transmission line which would cross 86 miles of public land in the Big Smoky Valley in Nye and Lander Counties. Sierra Pacific's right-of-way application initiated BLM's environmental analysis process and the decision was made to prepare an Environmental Impact Statement (EIS) on the proposed transmission line and the Anaconda mine/mill complex. The EIS is being prepared on a contract basis by Environmental Research & Technology, Inc. (ERT), of Fort Collins, Colorado.

This report was prepared by ERT as a preliminary step in the EIS preparation process. The report provides detailed information on the air quality of potentially affected areas and discusses the impacts of the proposed project on these resources.

The Air Quality Technical Report consists of two separate documents. The initial report is supplemented by an Addendum which addresses the impacts associated with on-site power generation at the Anaconda Nevada Moly mine/mill complex. This action is considered in the text as Alternative 4, the No Action Alternative.

The air quality report is one of a series of ten technical reports prepared by ERT as background and documentary material for the EIS. Each report presents the results of field and literature studies in the affected environments and results of impact analyses. The technical reports are intended as background documents and information in them is, in many cases, considerably more detailed than will be included in the EIS.

Chapter 1, "Alternatives Including the Proposed Action", can be found in the Draft Environmental Impact Statement which is on file with copies of the technical reports at the following locations: BLM offices in Washington, D.C.; Reno; Battle Mountain; Carson City; Elko; Ely; Las Vegas; and Winnemucca, Nevada. The following public libraries will also receive copies: the Churchill Public Library, Fallon; Clark County Library, Las Vegas; the Elko County Library, Elko; the Esmeralda County Library, Eureka; the Lander County Library, Battle Mountain; the Mineral County Library, Hawthorne; the Nevada State Library, Carson City; the Nye County Library, Tonopah; the Washoe County Library, Reno; and the White Pine County Library, Ely. Draft EISs will also be sent to the University of Nevada Libraries in Reno and Las Vegas.

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ALTERNATIVES INCLUDING THE PROPOSED ACTION

(Refer to the Draft Environmental Impact Statement)

CHAPTER 2

AFFECTED ENVIRONMENT

INTRODUCTION

The following is a description of the air environment as it presently exists at and near the proposed Anaconda Molybdenum project located in the state of Nevada on the west edge of the Great Basin. The proposed mine/mill complex is located in the Big Smoky Valley on the western slope of the San Antonio Mountains, approximately 18 miles north northwest of Tonopah, in Nye County. The mine/mill complex and proposed transmission line corridors would lie in this sparsely populated desert region which is virtually undeveloped.

This section describes the existing climatology and air quality of the region associated with the mine/mill complex and transmission line. Evaluation of these conditions is based on a review of literature, field data from site monitoring conducted from July 1978 through the present, and contact with Nevada State Air Quality Office personnel.

CLIMATIC ENVIRONMENT

Regional Climatology

The western Great Basin region in the southwestern United States has a middle latitude desert and steppe climate. The complex geographical setting of the region dictates weather and climate with latitude, elevation, and continentality as the contributing factors.

This regional area lies within the mid-latitude belt of the prevailing western winds for the majority of the year. These winds normally bring frequent changes of weather to the area. During the autumn, winter, and spring seasons mid-latitude storms riding the westerly winds move through the region bringing unsettled weather over wide areas contributing various amounts of precipitation. During the summer period, the westerly winds move northward with the jet stream, resulting in little or no change in the day to day weather pattern.

The Great Basin is a rugged, elevated area geographically located between the Sierra Nevada and the Rocky Mountains. The region itself is dominated by numerous mountain ranges, elevated deserts, basins, and valleys. The major mountain ranges are oriented in a north-south direction. Elevations in the Central Great Basin range from several thousand feet above sea level to well above 12,000 feet in the highest mountain peaks. The variability of elevation contributes significantly to the climate in two ways. First the temperatures decrease with increased elevation, resulting in substantial temperature differences between mountain ridges and low lying basins. Secondly, precipitation increases with increased elevation resulting in a spatially irregular precipitation pattern in the region. Annual precipitation amounts vary widely, from less than 4 inches in the drier southern valleys to more than 30 inches in the high mountain ranges to the northeast. The increased precipitation pattern at higher elevations in the chief contributor to the water supply of the area.

The Central Great Basin, and more specifically southwestern Nevada, is located approximately 270 miles from the Pacific Ocean. The direct effects of the ocean are all but negated by the presence of the Sierra

Nevada Mountain range, with sustained elevations in excess of 10,000 feet. Moisture for storms in this region comes primarily from the Pacific Ocean and is carried inland by the prevailing westerly winds. As the moist air ascends the western slopes of the Sierras, it is cooled, resulting in substantial precipitation and moisture loss. During its descent into the Great Basin, the air warms by compression and reaches the region drier and capable of producing only light to moderate precipitation even during the stormiest periods. This rainshadow effect is the primary reason for the arid climate and low humidities present in the Central Great Basin throughout the year.

The seasonal variation in climate is very pronounced in the Central Great Basin due to the periodic invasion of different air masses throughout the course of a year. The continental polar air mass which brings cool dry weather and cold nights to the Great Basin dominates the region from November to April. The periodic intrusion of maritime polar air from the North Pacific during this period results in the confrontation of the two air masses creating stormy conditions and wide area precipitation.

In summer the Great Basin is dominated by continental tropical air, which occurs on more than half of all days from May to October (Houghton et al. 1975). It brings sunny, warm and dry weather for prolonged periods during the warm seasons, when entire months may pass without measurable rainfall. The summer is not always without precipitation, however. In July, August, and September maritime tropical air will sometimes flow southward from the tropical Pacific Ocean bringing local thunderstorms with occasional heavy rain to the region.

Most of the Central Great Basin region experiences a large diurnal temperature range caused by bright and abundant sunshine rapidly warming

the relatively thin dry air during daylight hours followed by rapid radiational cooling after sunset. Daily range in temperatures during all seasons may be as much as 40°F and frequently exceeds 50°F during the fall season (Rush and Schroer 1970). The average percentage of possible sunshine is about 80 (Houghton et al. 1975).

The large diurnal variation in surface temperature and the general persistence of climate in the Central Great Basin together create the following daily pattern of atmospheric stability. Air cooled at the surface of the mountains flows down into the valleys at night enhancing the surface radiation temperature inversion, in which the normal temperature decrease with height is reversed. Winds at the surface are generally calm during the inversion and vertical mixing of air beneath the inversion top is restricted. After sunrise, the air near the surface warms rapidly and burns out the inversion, leading to a normal vertical temperature structure. Continued surface heating creates a condition where warmer air near the ground becomes thermally unstable and strong vertical mixing is induced. This pattern is for the most part a daily occurrence. Low level radiation inversions are more common in this region than almost anywhere else in the contiguous United States (Houghton et al. 1975). Tables 2-1, 2-2, and 2-3 present the seasonal and diurnal frequency and magnitude of the mean mixing layer conditions which exist in the western Great Basin. Although the annual mean morning inversion depth appears to be somewhat less than 250 meters, the frequency of occurrence of surface-based inversions is high (90%) (Holtsworth and Fisher 1979). Afternoon mixing conditions are generally good throughout the year. Persistent air stagnation would generally exist only during the winter season when afternoon mixing heights are

TABLE 2-1

APPROXIMATE FREQUENCY BY SEASON OF SURFACE BASED INVERSIONS IN THE WESTERN GREAT BASIN

	Percent Occurrence			
	Spring	Summer	Fall	Winter
Morning	80%	90%	>80%	>90%
Afternoon	0	0	0	<10%

TABLE 2-2

APPROXIMATE FREQUENCY OF SURFACE BASED INVERSIONS AT LEAST 250 METERS ABOVE GROUND LEVEL IN THE WESTERN GREAT BASIN

	Percent Occurrence				
	Spring	Summer	Fall	Winter	Annual
Morning	<30%	30%	40%	50%	N/A
Afternoon	0	0	0	0%	<1%

TABLE 2-3

MEAN MIXING HEIGHTS IN THE WESTERN GREAT BASIN

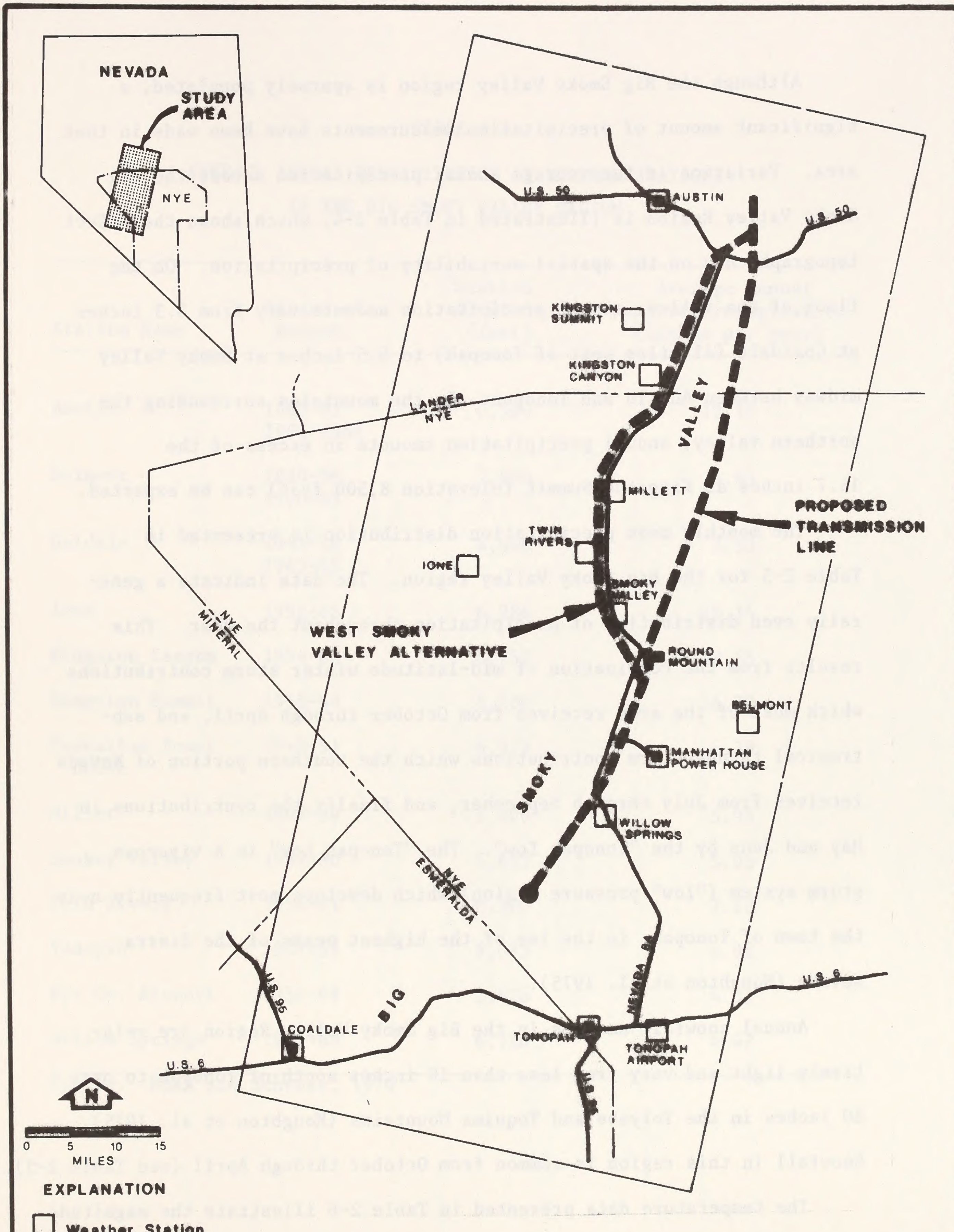
	Altitude (meters above ground level)				
	Spring	Summer	Fall	Winter	Annual
Morning	600	300	300	350	400
Afternoon	2,800	3,400	2,100	1,100	2,400

Source: Holtzworth, 1972

low and surface-based inversions are present. At all other times, sufficient surface heating is guaranteed and good vertical mixing is the rule by the afternoon. This is best illustrated in Table 2-3, which shows the annual afternoon mean mixing depth to be approximately 2,400 meters above ground level (Holtsworth 1972).

Climatology of the Big Smoky Valley

The Big Smoky Valley is in central Nevada and includes parts of Lander, Nye, and Esmeralda counties, and a very small part of Mineral County. Austin is near the north end of the valley; Tonopah, near the south end. The Big Smoky Valley (see Map 2-1) is one of the largest valleys in the state of Nevada (Rush and Schroer 1970). Elevations on the floor of the valley range from 4,800 feet in the south portion of the valley west of Tonopah to elevations in excess of 5,600 feet in the central portion of the valley. The width of the Big Smoky Valley varies from 6 miles to 23 miles and the surrounding topography consists of four separate mountain barriers. The Cedar Mountains and the San Antonio Mountains provide the west and east walls in the extreme southern portion of Big Smoky Valley. The elevations increase to a maximum 7,996 feet in the Cedar Mountains and 8,498 feet on San Antonio Peak in the southeastern portion of the region. The northern portion of the valley lies between two substantial mountain ranges which are part of the Toiyabe National Forest. The Toiyabe Range on the west side of the valley is more than 25 miles wide and rises to elevations in excess of 11,000 feet with Arch Dome Peak at 11,775 feet. On the east side of the valley the Toquima Range rises to elevations above 10,000 feet, with Mt. Jefferson at 11,807 feet.



Map 2-1. Big Smoky Valley region with location of precipitation measurement stations

Although the Big Smoky Valley region is sparsely populated, a significant amount of precipitation measurements have been made in that area. Variation in the average annual precipitation across the Big Smoky Valley Region is illustrated in Table 2-4, which shows the effect topography has on the spatial variability of precipitation. On the floor of the valley, annual precipitation amounts vary from 3.3 inches at Coaldale (41 miles west of Tonopah) to 5.5 inches at Smoky Valley midway between Austin and Tonopah. In the mountains surrounding the northern valley, annual precipitation amounts in excess of the 16.7 inches at Kingston Summit (elevation 8,500 feet) can be expected.

The monthly mean precipitation distribution is presented in Table 2-5 for the Big Smoky Valley region. The data indicate a generally even distribution of precipitation throughout the year. This results from the combination of mid-latitude winter storm contributions which most of the area receives from October through April, and subtropical thunderstorm contributions which the southern portion of Nevada receives from July through September, and finally the contributions in May and June by the "Tonopah Low". The "Tonopah Low" is a vigorous storm system ("low" pressure region) which develops most frequently near the town of Tonopah, in the lee of the highest peaks of the Sierra Nevada (Houghton et al. 1975).

Annual snowfall amounts in the Big Smoky Valley Region are relatively light and vary from less than 10 inches south of Tonopah to over 80 inches in the Toiyabe and Toquima Mountains (Houghton et al. 1975). Snowfall in this region is common from October through April (see Table 2-5).

The temperature data presented in Table 2-6 illustrate the magnitude of variation in seasonal temperatures for the southern Big Smoky Valley.

TABLE 2-4

AVERAGE ANNUAL PRECIPITATION AT WEATHER STATIONS IN THE BIG SMOKY VALLEY REGION

Station Name	Period of Record	Station Altitude (feet)	Average Annual Measure Precipitation (inches per year)
Austin	1889-91 1896-1968	6,594	12.15
Belmont	1889-96 1900-05	7,600	8.53
Galdale	1941-58 1963-65	4,646	3.33
Ione	1952-68	6,986	10.14
Kingston Canyon	1954-68	6,750	13.65
Kingston Summit	1955-68	8,500	16.70
Manhattan Power House	1948-51	6,911	5.78
Millet	1907-39	5,500	5.95
Smokey Valley	1949-60	5,625	5.93
Twin Rivers	1956-61	6,500	7.10
Tonopah	1907-53	6,093	4.98
Nye Co. Airport	1954-68	5,426	4.31
Willow Springs	1941-48	6,120	4.47

Source: Rush and Schroer, 1970

TABLE 2-5

AVERAGE MONTHLY DISTRIBUTION OF PRECIPITATION IN THE BIG SMOKY VALLEY REGION

Station Location	Period of Record	Station Altitude (feet)		Monthly Mean Precipitation (inches) Month of the Year J	F	M	A	M	J	J	A	S	O	N	D	Annual Average
Smoky Valley	1951-60[a/]	5,625	Mean	.75	.33	.74	.66	.49	.30	.51	.32	.32	.28	.61	.61	5.92
			Maximum	2.74	.87	3.77	2.33	2.77	.81	1.00	1.19	.58	1.50	1.72	3.20	11.74
Millet	1907-39[b/]	5,500	Mean	.60	.51	.49	.51	.49	.51	.55	.51	.44	.50	.29	.49	5.89
Tonopah	1907-43[b/]	6,903	Mean	.42	.41	.53	.58	.37	.21	.38	.44	.35	.48	.34	.38	4.89
Nye Co. Airport	1941-70[c/]	5,426	Mean	.31	.33	.23	.32	.45	.35	.49	.37	.35	.38	.39	.24	4.21

Station Location	Period of Record	Station Altitude		Monthly Mean Snowfall (inches) Month of the Year J	F	M	A	M	J	J	A	S	O	N	D	Annual Average
Nye Co. Airport	1954-60[(a)]	5,426	Mean	2.6	2.2	2.2	.8	T					.7	.6	6.9	13.8
			Maximum	12.4	6.0	6.6	4.0	T					4.2	2.5	12.4	N/A

a/ U.S. Dept. Commerce, 1965

b/ Rush and Schroer, 1970

c/ U.S. Dept. of Commerce, 1979

TABLE 2-6

TYPICAL RECORDED TEMPERATURES AND EXTREMES IN THE BIG SMOKY VALLEY REGION

Station Location	Period of Record	Station Altitude (feet)		Monthly Temperature (°F) Month of Year J	F	M	A	M	J	J	A	S	O	N	D	Average	(Extreme)
Smoky Valley	1951-60 a/	5,625	Mean	29.0	34.5	38.3	46.3	55.0	64.5	61.6	69.4	61.8	50.0	37.5	30.5	49.0	
			Highest Maximum	62	70	74	83	92	100	100	100	96	84	81	64		(100)
			Lowest Minimum	-20	-2	-1	6	14	20	39	32	25	10	1	-8		(-20)
Nye Co. Airport	1935-52 b/	5,246															
			Average Maximum	37	42	50	60	69	69	88	86	77	64	50	41	62	
			Average Minimum	22	25	30	38	45	52	61	60	52	42	33	25	41	
			Highest Maximum	--	--	--	--	--	--	--	--	--	--	--	--		(108)
			Lowest Minimum	--	--	--	--	--	--	--	--	--	--	--	--		(-15)
Tonopah Test Range	1961-67 c/	5,388	Mean	28	34	38	47	56	65	74	72	62	53	38	29	50	
			Average Maximum	44	49	52	62	71	79	90	88	79	70	54	45	65	
			Average Minimum	13	20	24	31	40	48	54	54	44	36	25	17	34	
			Highest Maximum	65	70	78	82	92	102	100	98	91	87	74	64		(102)
			Lowest Minimum	-24	-5	1	9	10	30	41	40	28	15	-3	-15		(-24)

a/ U.S. Dept. Commerce, 1965

b/ ERT, 1979

c/ Schaeffer, 1968

Maximum daily temperatures exceed 90°F routinely during the summer months and minimum temperatures can be expected to plummet well below zero during the winter season, as illustrated by the-24°F temperature recorded on 24 January 1962 at the Tonopah test range station located 35 miles southeast of Tonopah.

Generally, surface wind speeds are light (ERT 1979) throughout the region and wind direction characteristics are primarily the result of interaction between local topography and strong diurnal heating and cooling. Analysis of four-year wind speed and direction distributions for Nye County airport data (ERT 1979) shows an average wind speed of 7 miles per hour and the dominant wind directions aligned with the surrounding terrain. The diurnal heating and cooling cycle provides the mechanism whereby cold air drains off high terrain during nighttime hours and during daylight hours reverses to an upslope flow.

The Nye County airport is located 8 miles east of Tonopah in the southern end of the Ralston Valley which runs north/south and drains the east slopes of the San Antonio Mountains, the southern Toquima Range and the west slopes of the Monitor Range. Near the airport the valley is 15 miles wide and reasonably exposed. The Nye County airport data indicate over 40% of the wind directions are from the northern quadrant (NNW-N-NNE). For comparison, six years of wind data from the Tonopah test range located in a well exposed area 30 miles south of the airport indicate a frequency of 12.5% of all winds from that same quadrant (Schaeffer 1968).

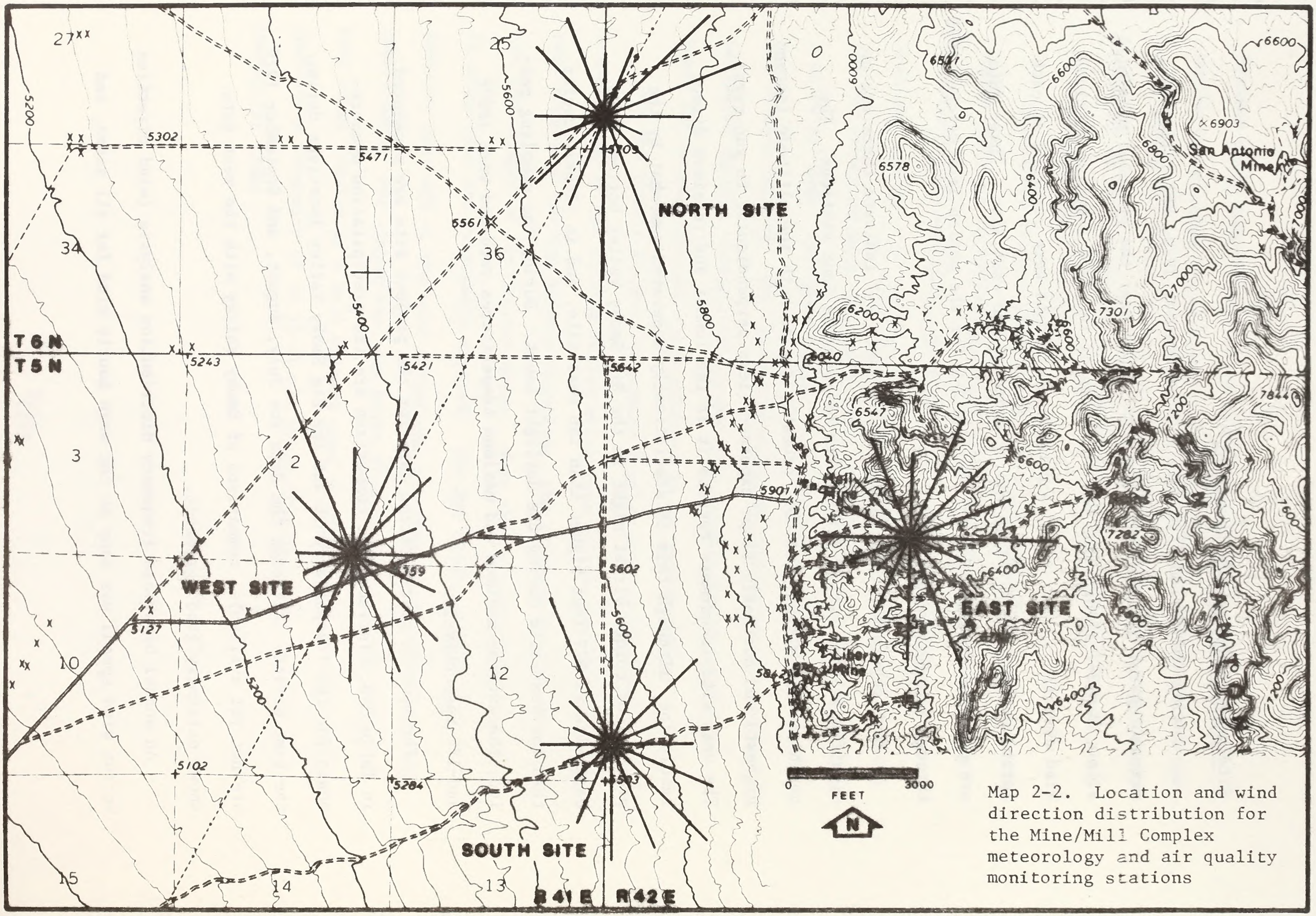
Site Meteorology-Mine/Mill Complex

During the period from July 1978 to October 1979, ERT collected meteorological data at four locations on and near the proposed mine/mill site. Map 2-2 illustrates the locations of the data sampling stations. Wind direction, wind speed, and temperature data were recorded at each location, and precipitation was recorded at the west site. These data are presented in Tables 2-7, 2-8, and 2-9 for the period from October 1978 through September 1979.

The temperature data summarized in Table 2-7 indicate there are no significant temperature differences between the four stations. The north site is slightly colder, probably due to both the altitude (second highest) and northerly slope exposure (less perpendicular to sun rays). The west site is warmest because it is the lowest and receives direct insolation, although this is statistically moderated somewhat by the presence of colder air at night in the Big Smoky Valley bottom. The east site is 877 feet higher than the west site, and is clearly cooler than the west site during the daylight hours. During the sampling period, the extreme minimum and maximum temperatures recorded were 100°F and-1°F respectively.

The monthly precipitation data for the project site are presented in Table 2-8. Included for comparison are the precipitation measurements for the Tonopah airport and the Big Smoky Valley locations during the same period. Although the data for July, August, and September 1979 are not yet available, comparison of Smoky Valley with the west site shows extremely good agreement.

An annual bivariate frequency distribution analysis (wind direction versus wind speed) was done on the mean hourly wind for all sites, and



Map 2-2. Location and wind direction distribution for the Mine/Mill Complex meteorology and air quality monitoring stations

TABLE 2-7

SUMMARY OF TEMPERATURE DATA AT THE PROPOSED MINE/MILL COMPLEX FROM THE MEAN HOURLY VALUES FOR THE ONE YEAR PERIOD 10/78 THROUGH 9/79

		Temperature (°F) Month of Year											
		J	F	M	A	M	J	J	A	S	O	N	D
Mean Daily Temperature													
	Elevation (ft.)												
West Site	5,323	24	31	40	48	60	N/A	75	72	71	62	34	23
North Site	5,695	21	28	36	44	55	66	72	67	68	58	31	22
East Site	6,200	22	30	36	45	55	67	80	71	71	58	33	24
South Site	5,520	24	33	N/A	46	55	66	71	64	67	57	32	23
Average Maximum Daily Temperature													
West Site		31	41	50	60	72	N/A	88	86	85	75	44	33
North Site		27	37	45	55	66	78	85	79	80	69	39	34
East Site		26	37	46	56	66	73	91	81	82	67	40	32
South Site		30	43	N/A	57	66	77	86	77	80	70	41	33
Average Minimum Daily Temperature													
West Site		17	22	30	35	47	N/A	61	58	57	47	25	14
North Site		15	20	28	32	43	53	59	54	56	49	24	17
East Site		17	23	28	34	44	55	68	60	62	48	27	20
South Site		17	28	N/A	32	43	52	58	52	54	44	23	14

N/A - Not Available

TABLE 2-8

COMPARISON OF RECORDED MONTHLY PRECIPITATION NEAR THE PROPOSED MINE/MILL COMPLEX FOR THE ONE YEAR PERIOD 10/78 THROUGH 9/79

Station	Station Elevation (feet)	Total Precipitation (inches) Month of Year											
		J	F	M	A	M	J	J	A	S	O	N	D
West Site	5,323	0.25	0.21	0.79	0.03	0.14	0.03	1.12	1.37	0.28	N/A	N/A	N/A
Tonopah AP[a/]	5,426	0.67	0.45	0.70	0.00	0.00	0.03	N/A	N/A	N/A	0.76	0.53	0.46
Smoky Valley[a/]	5,625	N/A	N/A	0.79	0.12	0.12	0.00	N/A	N/A	N/A	0.89	1.24	0.55

N/A - Not Available

a/ U.S. Dept. of Commerce, 1979

TABLE 2-9

ANNUAL SUMMARY OF WIND SPEED AND DIRECTION AT THE PROPOSED MINE/MILL COMPLEX FOR THE ONE YEAR PERIOD 10/78 THROUGH 9/79[a]

Direction	South Site		West Site		North Site		East Site	
	Frequency (%)	Mean Speed (mph)	Frequency (%)	Mean Speed (mph)	Frequency (%)	Mean Speed (mph)	Frequency (%)	Mean Speed (mph)
N	7.8	8.9	7.1	8.7	4.5	8.3	5.8	9.4
NNE	9.0	9.4	10.3	8.3	4.9	9.4	8.6	8.7
NE	8.1	8.7	7.4	8.3	9.7	10.1	7.3	10.7
ENE	3.5	5.8	4.6	5.6	9.6	9.2	7.3	9.2
E	5.2	5.1	4.9	5.1	5.6	6.0	9.7	5.6
ESE	7.4	6.9	5.9	6.9	2.7	5.6	3.8	6.3
SE	9.1	9.6	8.1	9.6	3.9	7.2	4.4	9.8
SSE	7.5	10.5	8.4	9.8	10.9	10.7	9.1	12.8
S	7.7	11.2	8.5	10.1	10.7	11.2	8.1	12.8
SSW	5.7	8.0	4.5	6.5	6.2	9.6	5.2	9.8
SW	3.3	5.6	3.3	5.4	6.2	7.4	2.9	7.4
WSW	3.8	4.9	3.3	4.7	3.6	5.4	4.2	6.5
W	4.8	5.4	3.6	5.4	4.6	6.5	6.0	6.0
WNW	2.8	6.3	2.8	6.9	3.6	7.8	4.8	7.6
NW	4.1	8.9	5.8	11.0	6.5	10.7	5.3	11.0
NNW	10.4	11.2	11.6	9.8	7.0	10.3	7.3	10.3
Average		8.5		8.2		9.1		9.2
Total Hours	7291		7069		7567		7918	

[a] Data were recorded at 10 meters above ground level.

the results are summarized in Table 2-9. The wind roses in Map 2-2 illustrate the results of the wind direction analysis. In these diagrams the length of each line is representative of the relative frequency of wind from the direction toward which the line points. The channeling effect of the Big Smoky Valley is clearly depicted by the north, south, and west stations. The north site shows a northeasterly component which is probably a result of the Big Smoky Valley drainage flowing around the north end of the San Antonio Mountains. The westerly influence of synoptic winds is present in all the wind roses but is not dominant at any of the sites. The large easterly peak at the east station is due primarily to the local nocturnal drainage from the San Antonio Peak slope extending 3 miles east, and approximately 2,200 feet higher than the mine/mill site.

Additional climatological information about the project area which may be useful for land reclamation, revegetation, and general mine/mill complex operation purposes is summarized below (Houghton et al. 1975).

1. The average number of days per year with measureable precipitation (.01 inch or more) is approximately 38.

2. The average number of days per year with icing fog potential is approximately three.

3. The 25-year <u>estimated</u> fastest mile wind is in excess of 60 mph.

4. The maximum precipitation to be expected within a 24 hour period on an average of once every 50 years is 2.0 to 2.4 inches.

5. The average frequency of thunderstorm activity is 10 to 15 days per year.

6. The average growing season based on the number of days during which temperatures remain above 32^{o}F is approximately 140.

EXISTING AIR QUALITY

The study area is sparsely populated and generally undeveloped. Scattered population centers and industry are not large enough to generate significant quanities of air pollutants. Local air flows, atmospheric stability conditions, and topographic and ground conditions determine the diffusion characteristics of specific areas and consequently the extent and distribution of pollutant concentrations from any nearby sources. Light wind speed and the abundant sunshine imply frequent unstable conditions and good atmospheric dispersion throughout most of the year.

The existing air quality of the region is excellent. Periodic sampling for nitrogen oxides and sulfur dioxide conducted by the Nevada State Air Quality Office (Serdoz, personal communication 1979) indicates the absence of detectable background concentrations for these pollutants. No data for photochemical oxidants are available for the area. Inquiries on backround levels for atomic radiation were not conducted. The largest source of pollutants in the study area is naturally and mechanically generated particulate matter.

The state of Nevada has been monitoring TSP (Total Suspended Particulate) concentrations in the Tonopah area since 1972. The Tonopah monitor consistently measures TSP concentrations far below the federal and state standards. For the period of 1972 through 1977, annual geometric mean TSP concentrations averaged 21 micrograms per cubic meter ($\mu g/m^3$) (ERT 1979).

In the summer of 1978, the Anaconda Company established a monitoring network to measure TSP concentrations at the mine/mill site as

required by EPA-PSD (Environmental Protection Agency - Prevention of Significant Deterioration) regulations. The field sampling has been conducted since July 1978 at the four meteorological stations in the mine/mill complex area. Data for the sampling year October 1978 through September 1979 are presented in Table 2-10. The data indicate a combined annual geometric mean concentration for the area of approximately 16.1 $\mu g/m^3$. The distribution of TSP values by season illustrates a considerable variation of concentrations between winter and summer. This is probably the result of the increased frequency of dust devils (small dust storms) in the warmer months and stable air and wet or frozen ground conditions in the winter months. No significant correlation could be found for TSP concentrations and wind speed. The largest contributing factor to particulate loading in the atmosphere appears to be the condition of the ground. Disturbed soils and lack of vegetative cover seem to result in higher values of TSP. All the monitoring sites had similar ground conditions and, as expected, the data suggest little difference in TSP concentrations between sites.

Eight TSP samples from the west site #1 (colocated samplers) were analyzed for trace elements. The results from the analyses are listed in Table 2-11.

In spite of the limited data available for background atmospheric pollutants in the region, the above evaluation of the existing air quality information suggests a generally clean air environment in the project area.

TABLE 2-10

SUMMARY OF TOTAL SUSPENDED PARTICULATE CONCENTRATIONS ($\mu g/m^3$) AT THE PROPOSED MINE/MILL COMPLEX FOR THE ONE YEAR PERIOD 10/78 THROUGH 9/79

	TSP Concentrations ($\mu g/m^3$)				
	Fall	Winter	Spring	Summer	Annual
Site	9/79 10/78 11/78	12/78 1/79 2/79	3/79 4/79 5/79	6/79 7/79 8/79	10/78-9/79
North	13.4	4.8	20.4	23.4	15.8 (54 samples)
East	15.1	6.2	17.5	18.3	14.7 (43 samples)
South	13.2	9.0	12.7	29.4	12.8 (29 samples)
West #1	12.9	6.4	21.9	23.6	16.6 (49 samples)
West #2	17.5	6.8	24.9	22.7	18.8 (52 samples)
Average	14.5 (39 samp.)	6.7 (67 samp.)	20.9 (59 samp)	22.7 (63 samp.)	16.1 (277 samples)

Maximum: 82.3 at West #2 on 4/9/79

Minimum: 0.4 at South on 12/4/78

TABLE 2-11

TRACE ELEMENT ANALYSIS WEST SITE #1

($\mu g/m^3$)

Date	SO^4 (Sulfates)	NO^3 (Nitrates)	Pb (Lead)	Cu (Copper)	Cd (Cadmium)	HG (Mercury)
11/4/78	1.999	.885	<.107[a/]	<.014[a/]	<.007[a/]	<.002[a/]
11/16/78	1.441	.476	<.107[a/]	<.014[a/]	<.007[a/]	<.002[a/]
11/28/78	1.457	.262	<.107[a/]	.036	<.007[a/]	<.002[a/]
12/10/78	1.453	.189	<.107[a/]	<.014[a/]	<.007[a/]	<.002[a/]
12/28/78	1.656	.756	<.107[a/]	<.014[a/]	<.007[a/]	<.002[a/]
1/3/79	2.260	.226	<.107[a/]	.035	<.007[a/]	<.002[a/]
1/15/79	.694	.722	<.107[a/]	.035	<.007[a/]	<.002[a/]
1/27/79	2.473	.467	<.107[a/]	.014	<.007[a/]	<.002[a/]

a/ Detection limit

SUMMARY

The climatology of the mine/mill complex and proposed transmission line corridor is typical of other locations in the Great Basin. The climate displays a large spacial and temporal variation in temperature, precipitation, and wind, characteristic of areas with complex terrain. The strong diurnal variation in temperature and high insolation guarantee good atmospheric dispersion of natural and manmade effluents for most days.

The lack of population and industrial development in the region have resulted in minimum air pollution impact on the ambient pristine conditions. Investigation of backround levels of fugitive dust and other air pollutants suggest that man's impact on the air environment in this region has been minimal.

CHAPTER 3

ENVIRONMENTAL CONSEQUENCES

CLIMATE

The climate of the study area would not be impacted by the construction or operation of a transmission line. However, climate has influence on other impacts which are important considerations, such as soil erosion, removal of vegetation, and subsequent revegetation. These relationships are beyond the scope of this discussion and are discussed in the appropriate disciplines.

AIR QUALITY

The proposed action will influence air quality as a result of particulate emissions from both fugitive dust sources and industrial processes.

Evaluation Criteria and Assumptions

Particulate concentrations in the atmosphere are regulated by both state and federal agencies. In both cases, the concern is for total suspended particulates (TSP) which are measured by high-volume (hi-vol) air samplers. Both the State of Nevada and the Environmental Protection Agency (EPA) require that an application for permission to construct be approved prior to commencing construction. Applications to both of these agencies have been approved for the proposed action, and these documents form the basis for this assessment of air quality impacts (ERT

1978, 1979). The applications were prepared in late 1978 and early 1979. Since this time, changes have occurred in both the project and the regulatory procedures.

The governing criteria on which these permits are approved or denied are the compliance of anticipated ground-level concentrations with both National Ambient Air Quality Standards (NAAQS) and prevention of significant deterioration (PSD) increments. For TSP these criteria are shown in Table 3-1. The NAAQS are total concentrations, including background, while the PSD increments are just the increases over existing concentrations. The predictions of ground-level concentrations are made by an air quality model. The air quality model uses emission rate estimates and meteorological values as inputs and utilizes mathematical formulations to calculate the concentrations.

In the air quality permit applications prepared previously, emission rate estimates were divided into two categories in keeping with both state and federal procedures in effect at the time. One group of sources, called fugitive dust sources, consisted of the particulates produced by the mining operations, the traffic on unpaved roads, and wind erosion from the exposed areas. For these sources, regulations did not require air quality modeling. The other group of sources, called industrial process emissions, included emissions from the molybdenum concentrator, the molybdenum dryer and the coarse ore stockpile. This latter group of emission sources was modeled.

The meteorological values required by the model are wind speed and wind direction data, as well as a characterization of atmospheric stability and vertical mixing depth. Ideally, the data should be taken at the site and should cover at least a year. Such data were not available

TABLE 3-1

STATE OF NEVADA AND U.S. EPA RULES GOVERNING AIR QUALITY CONCENTRATIONS FOR TSP

	Maximum Allowable Total Concentration ($\mu g/m^3$)	Maximum Allowable Increment Concentration ($\mu g/m^3$)
State of Nevada		
Annual Geometric Mean	60	19
24-hour Maximum	150	37
U.S. EPA	(NAAQS)	(PSD)
Annual Geometric Mean	75 (60)[a]	19
24-hour Maximum	260 (150)[a]	37

[a] The values shown in parentheses are secondary standards.

at the Anaconda project site for the minimum time period, thus an alternate approach was used. Since it was necessary to analyze for only two averaging times (annual and 24-hour maximum), separate analyses were carried out for each case. Annual averages were analyzed using long-term data taken at the Tonopah airport located in the Ralston Valley south and east of the project site. Maximum 24-hour concentrations were analyzed by establishing a number of "worst-case" scenarios and calculating the ground-level concentrations for each case. The cases analyzed included the possibility of an 8-hour persistence from any direction. For each case, stabilities and mixing depths were chosen to reasonably represent worst cases.

The air quality modeling conducted for the proposed action was based on the Gaussian-plume formulation, in which the downwind concentrations are assumed to be distributed in a Gaussian function about the plume centerline, aligned with the wind direction. The model did incorporate a treatment for the effects of terrain on downwind plume height.

Effects of Implementing the Proposed Action

Mine/Mill Complex

Impacts. Estimates were made of the particulate emissions which would result from the mine/mill complex during full-scale operations. The particulate emissions from the operation of the mine/mill complex are direct impacts. Sources of these particulate emissions include removal and hauling of overburden and ore, road maintenance, wind erosion, vehicular exhaust, and ore processing in the mill. Total emissions were estimated to be 1600.5 tons per year, or a maximum for a 24-hour period of 417.0 pounds per hour (Table 3-2). The fugitive dust emissions from the mine/mill complex were not considered significant for the reasons described under specific assumptions and analysis guidelines.

As noted previously, only industrial process emissions must be considered in the air quality modeling for NAAQS and PSD compliance. From these sources, emissions were calculated as 15.1 tons per year, and the maximum emission rate for a 24-hour period was calculated as 4.1 pounds per hour. Annual average TSP concentrations resulting from industrial process sources were calculated by the model as a highest value of 1.4

TABLE 3-2

ESTIMATES OF PARTICULATE EMISSION FROM
THE ANACONDA NEVADA MOLY PROJECT

Sources	Uncontrolled Emissions (ton/yr)	Control Factor	Basis for Control	Controlled Emissions Annual (ton/yr)	Controlled Emissions Max 24-hr (lb/hr)
Fugitive Dust Sources					
Overburden drilling	7.8	1.0	--	7.8	--
Overburden blasting	4.4	1.0	--	4.4	--
Overburden removal	317.0	1.0	--	317.0	83.8
Haul road construction and repair	69.0	0.5	watering	34.5	9.1
Haul road traffic	1,940.0	0.5	watering	970.0	257.0
Overburden dumping	19.8	1.0	--	19.8	5.3
Wind erosion	96.2	1.0	--	96.2	22.0
Ore removal	127.0	1.0	--	127.0	33.5
Ore dumping	8.0	0.3	water spray	2.4	0.7
Subtotal	2,589.2			1,579.1	411.4

TABLE 3-2 (CONTINUED)

ESTIMATES OF PARTICULATE EMISSION FROM
THE ANACONDA NEVADA MOLY PROJECT

Sources	Uncontrolled Emissions (ton/yr)	Control Factor	Basis for Control	Controlled Emissions Annual (ton/yr)	Controlled Emissions Max 24-hr (lb/hr)
Vehicular Exhaust					
Diesel/Gasoline Exhaust	N/A	N/A	N/A	6.3	1.5
Industrial Process Sources					
Concentrator	13.9	0.004	wet scrubber	11.2	3.2
Coarse ore stockpiles	2.4	1.0	--	2.4	0.6
Molybdenum dryer	370.0	0.004	wet scrubber	1.5	0.3
Subtotal	386.3			15.1	4.1
TOTAL	2,975.5			1,600.5	417.0

micrograms per cubic meter ($\mu g/m^3$). This is well below the maximum allowable PSD increment of 19 $\mu g/m^3$ for annual average concentrations. Additionally, when added to the annual geometric mean TSP concentration of 16.1 $\mu g/m^3$ currently measured at the site, the maximum impact is still well below the NAAQS of 60 $\mu g/m^3$.

Maximum 24-hour concentrations of TSP were predicted to occur for both south-southwesterly and north-northwesterly wind directions and resulted in a concentration of 6.5 $\mu g/m^3$. This value is well below the 24-hour PSD increment of 37 $\mu g/m^3$. It is not correct to add this prediction to the highest measured 24-hour concentrations to determine compliance with the NAAQS because high measured TSP concentrations result during high wind speeds, while the maximum impact predictions are for low wind speeds. For this reason, the mine/mill complex would not result in concentrations which exceed the 24-hour NAAQS.

Since the proposed action is not expected to result in concentrations which exceed any of the air quality criteria, no mitigation is recommended other than that which has already been incorporated in the project design. As part of the EPA permit proceedings, it was necessary for the Anaconda Company to demonstrate that the proposed action is utilizing the best available control technology given economic and energy consumption constraints. In granting the permit, the EPA has agreed with this determination. The proposed control actions do include the utilization of a dynamic wet scrubber system to control particulate emissions from the process sources as well as an extensive watering program to control the fugitive dust emissions from the mining operations.

230 kV Transmission Line

There are no detectable air quality effects from the 230kV transmission line during operations. Transmission lines cause ionization of the surrounding air (corona effect) and result in the formation of certain pollutants such as ozone and nitrogen oxides (corona effluents). This level of emissions from powerlines is considered insignificant. There would be some fugitive dust concentrations resulting from the construction of this line; however, the direct impacts are expected to be quite small and short in duration and are considered insignificant. There are no recommended mitigation measures for these fugitive dust

emissions, and there are expected to be no long-term unavoidable adverse impacts.

Unavoidable Adverse Impacts

Construction and operation of the mine/mill complex would result in a direct impact of controlled particulate emissions of approximately 1,600.5 tons per year. This is considered an insignificant impact because the estimated annual average and maximum 24-hour TSP concentration associated with the industrial process were modeled and would be well below the PSD increment and the NAAQS. Based on the accepted PSD and NAAQS criteria, it is anticipated that the proposed action would not significantly affect air quality.

Short-term Use Versus Long-term Productivity

The proposed action would involve short-term increases in total suspended particulate (TSP) levels in the region during operation of the project. Project emissions would not violate state and Federal air quality regulations or standards. In the long term, after closure, TSP emissions due to the proposed action would cease and there would be no long-term effect on air quality.

Irreversible and Irretrievable Commitment of Resources

Air quality impacts, by their nature, are reversible. By cessation of activities and proper reclamation of the land, the air quality can be returned to its orginal state assuming no increase in background levels.

<u>Effects of Implementing Alternative 1 (West Smoky Corridor)</u>

Implementation of Alternative 1 would result in impacts identical to those described for the proposed action.

<u>Effects of Implementing Alternative 2 (Tower Designs)</u>

Implementation of Alternative 2 would result in impacts identical to those described for the proposed action.

Effects of Implementing Alternative 3 (Alternative Crushing/Grinding Circuit for Mine/Mill Complex)

Refer to Chapter 1 of DEIS for a description of the alternative grinding circuit and comparison with the proposed grinding circuit.

As indicated in Table 3-3 the total suspended particulate (TSP) emissions associated with the alternative would be identical to the proposed action with the exception of the emissions associated with the concentrator. Particulate emissions would be greater because of additional grinding and fine ore storage requirements. The particulate emissions from the operation of the mine/mill complex are direct impacts. Annual emissions for the concentrator were calculated to be 70 tons per year, and the maximum emission rate for a 24-hour period was calculated at 19.8 pounds per hour. This would increase the total TSP emissions from 1,600.5 to 1,655.4 tons per year.

The fugitive dust emissions from the mine/mill complex were not considered significant for the reasons described in the proposed action section of this chapter. Annual average TSP concentrations resulting from the industrial process emission rates were calculated by the model as a highest value of 5.9 micrograms per cubic meter ($\mu g/m^3$). This is well below the maximum allowable PSD increment of 19 $\mu g/m^3$ for annual average concentrations. In addition, when added to the annual geometric mean TSP concentration currently measured at the site of 16.1 $\mu g/m^3$, the maximum impact is still well below the National Ambient Air Quality Standards (NAAQS) of 60 $\mu g/m^3$.

Maximum 24-hour concentrations were predicted to occur for both south-southwesterly and north-northwesterly wind directions and resulted in a concentration of 31.4 $\mu g/m^3$. This value is below the 24-hour Prevention of Significant Deterioration (PSD) increment of 37 $\mu g/m^3$. It is not correct to add this prediction to the highest measured TSP concentrations to determine compliance with the NAAQS because high measured TSP concentrations result during high wind speeds, while the maximum impact predictions are for low wind speeds. For these reasons, the alternative would not result in concentrations which exceed the 24-hour NAAQS.

TABLE 3-3

ESTIMATES OF PARTICULATE EMISSIONS FROM

THE ANACONDA NEVADA MOLY PROJECT

(ALTERNATIVE 3 - CRUSHING AND GRINDING CIRCUIT)

Sources	Potential Emissions (ton/yr)	Controlled Emissions Annual (ton/yr)	Controlled Emissions Max 24-Hr (lb/hr)
Fugitive Dust Sources			
Overburden drilling	7.8	7.8	--
Overburden blasting	4.4	4.4	--
Overburden removal	317.0	317.0	83.8
Haul road construction and repair	69.0	34.5	9.1
Haul road traffic	1,940.0	970.0	257.0
Overburden dumping	19.8	19.8	5.3
Wind erosion	96.2	96.2	22.0
Ore removal	127.0	127.0	33.5
Ore dumping	8.0	2.4	0.7
Total	2,589.2	1,579.1	411.4
Vehicular Exhaust			
Diesel/Gasoline Exhaust	N/A	6.3	1.5
Industrial Process Sources			
Concentrator	13.9	66.1	18.9
Coarse ore stockpiles	2.4	2.4	0.6
Molybdenum dryer	370.0	1.5	0.3
Subtotal	386.3	70.0	20.1
TOTAL	2,975.50	1,656.1	433.0

Source: ERT EIS Team

Unavoidable Adverse Impacts

Construction and operation of the mine/mill complex would result in a direct impact of particulate emissions of approximately 1,655.4 tons per year. This is considered an insignificant impact because the estimated annual average and maximum 24-hour TSP concentration associated with the industrial process were modeled and would be well below the PSD increment and the NAAQS. Based on the accepted PSD and NAAQS criteria, this alternative would not significantly affect air quality.

Effects of Implementing Alternative 4, No Action

This alternative is discussed in the Addendum following Chapter 8 of this report.

Short-term Use Versus Long-term Productivity

Would be the same as the Proposed Action.

Irreversible and Irretrievable Commitment of Resources

Would be the same as the Proposed Action.

SUMMARY

Air quality impacts were analyzed using air quality modeling techniques based on the Baussian-plume formulation. Annual average and maximum 24-hour concentrations of particulates resulting from industrial process emissions were calculated with meteorological parameters taken at the Tonopah Airport and developed from a "worst-case" analysis. The modeling incorporated a treatment for the effects of terrain on plume height. Ground-level concentrations were all predicted to be in compliance with state and federal air quality regulations. No additional mitigation measures were recommended since both the EPA and the State have issued permits to the Anaconda Company for the project as proposed. The construction of the power line is not expected to result in any air quality impact.

CHAPTER 4

LIST OF PREPARERS

INTRODUCTION

The following individuals had primary responsibility for conducting the technical report. Their education, project responsibilities, qualifications, and experience are summarized below.

ENVIRONMENTAL RESEARCH AND TECHNOLOGY, INC.

STEPHEN R. ANDERSEN, Meteorologist

B.S. in Meteorology, San Jose State University.

Anaconda Nevada Moly Project: Responsible for the management and evaluation of the meteorological and air quality monitoring data collected at the mine/mill complex.

Experience includes evaluating meteorological and air quality data and providing interpretation and analyses of these data for use in environmental impact assessment, wind turbine siting and other industrial monitoring programs; design and development of numerous computer application systems for management, analysis and display of meteorological and air quality data; development of several national wind energy program computer display and analysis systems.

KIRK D. WINGES, Air Pollution Model Specialist

B. S. in Earth and Planetary Science, Massachusetts Institute of Technology; M.S., Chemical Engineering, University of California, Berkeley.

Anaconda Nevada Moly Project: Responsible for conducting the air quality impact analyses for the proposed mine/mill complex using computer models.

Experience includes studying the diffusion of emissions from anthropogenic sources and establishing mathematical representations for the behavior of these processes; modeling of emissions due to mining operations, electric power generation, and wind erosion; management of air quality mining studies in the state of Wyoming; development of a dispersion regional model for the state of Utah and surrounding regions.

KARL ZELLER, Meteorologist

B.S. Civil Engineering, Virginia Military Institute; M.S. in Meteorology, University of Utah; and Certified Consulting Meteorologist (CCM) accreditation.

Anaconda Nevada Moly Project: Responsible for coordination of climatology and air quality impact input in to project report and BLM EIS. Senior author of the air environment technical report.

Experience includes research meteorologist for EPA in support of all aspects of air pollution meteorology; support in establishing EPA's UNAMAP series of air quality dispersion models; air resource manager for BLM, responsible for establishing an air program within the BLM; regional air quality manager for ERT, responsible for ERT air study projects in the Rocky Mountain West.

CHAPTER 5

CONSULTATION AND COORDINATION

Consultation and coordination for the air discipline report has included meetings and/or telephone conversations with various federal and state agencies. The following specific activities have taken place as part of this program.

Date	Activity
6/8/78	Meeting between ERT, Anaconda, and EPA Region IX in San Francisco.
7/6/78	Meeting with Nevada Division of Environmental Protection Air Quality Control, Carson City, Nevada.
7/31/78	2nd meeting between ERT, Anaconda, and EPA Region IX in San Francisco.
9/14/78	Discussion with Nevada Division of Air Quality Control, Carson City, Nevada.
10/28/79	Discussion with Nevada Division of Air Quality Control, Carson City, Nevada.

Federal Government
Environmental Protection Agency
Region IX

State of Nevada
Department of Conservation and Natural Resources
Division of Environmental Protection Air Quality Control

CHAPTER 6

APPENDICES

APPENDIX A - METHODOLOGY

Introduction

Methods utilized in studies and data analyses for the air discipline report are discussed in this appendix.

Field monitoring, literature surveys, and agency contacts contributed the information for the analysis and preparation of the air environmental assessment.

Mine/Mill Complex

A detailed investigation of the Anaconda Nevada Moly Project near Tonopah, Nevada was conducted from July 1978 to October 1979. The objective of the monitoring program was to collect meteorological and air quality data sufficient for the assessment of the current range of pollutant concentrations and for the characterization of associated atmospheric dispersion and transport potential in the air surrounding the proposed Anaconda project.

The methodology of collection and reporting of the data is discussed in the monitoring plans prepared by ERT in July 1978 and March 1979. Please refer to these documents for a detailed discussion.

230 kV Transmission Line. Information on the existing air environment potentially affected by the transmission line was gathered through literature review, personnel communications, and extrapoliation.

Modeling

The impact of the proposed development on the ambient air quality of the region surrounding the project was assessed through air quality modeling. The Gaussian-plume based mode, ERTAQ, was used in the analysis. ERTAQ was originally developed for the EPA and has been used extensively throughout the west for impact analysis of mining developments. The model is very similar to the EPA's Climatological Dispersion Model (CDM). The primary differences between ERTAW and CDM are ERTAQ's ability to characterize line sources and a different treatment for area sources.

ERTAQ was modified to incorporate a treatment for particle deposition. To utilize this option, it is necessary to have detailed information on the particle size distribution of each source. Since such information was not available for the Anaconda project, the deposition function was not used in the evaluation. The particulate emissions were assumed to behave as a gaseous pollutant. The effect of such an assumption is the overprediction of concentrations. In general, model predictions are estimated to be accurate to within a factor of two.

ERTAQ was used to calculate both annual and 24-hour maximum concentrations. For the annual case, a stability wind rose developed from data taken at the Nye County Airport was used to characterize the meteorology. However, to establish maximum 24-hour concentration, it was necessary to first determine the meteorological conditions which are expected to produce the highest concentrations. This was accomplished by examining the site-specific data.

CHAPTER 7

GLOSSARY

This limited glossary was compiled with the intent of assisting the general reader, rather than the technician, with the terminology utilized in this report. Therefore, the Summary sections were the primary sources of words and terms presented in this listing.

AMBIENT - The word ambient is used to distinguish "outside" air from "inside" air. Ambient conditions are those experienced by an observer in the free atmosphere.

EFFLUENT - The exhaust gas or particulate that is released into the atmosphere from any process. Example: smoke is an effluent from a smoke stack.

GAUSSIAN PLUME - In air pollution modelling, this refers to an assumed vertical and horizontal Gaussian distribution of pollutant concentrations expected downwind from a source. Sources may be a point (smokestack), line (road), or area (stock pile). The Gaussian formulation is a general solution to the Fickian diffusion aquation assuming stationary and homogenous conditions.

INSOLATION - Radiant energy from the sun that strikes the earth. Important in air quality modelling since an insolation parameter is used to select atmospheric stability classification.

PLUME HEIGHT - The elevation of equilibrium that an exhausted continuous stream of exhaust gas or particulate reaches (effluent from a stack or "plume"). Plume height is equal to the physical height of a smoke stack (or any other such object) plus the plume rise experienced by the plume due to bouyancy and exit momentum.

CHAPTER 7

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EFFLUENT - The exhaust gas or particulates that are released into the atmosphere from any process. Exhaust smoke is an effluent from a smokestack.

GAUSSIAN PLUME - In air pollution modeling, this refers to an assumed vertical and horizontal Gaussian distribution of pollutant concentrations downwind from a source. Sources may be a point (smoke stack), line (road), or area (neighborhood). The Gaussian formulation is a general solution to the diffusion equation assuming stationarity and homogeneous conditions.

INSOLATION - Radiant energy from the sun that strikes the earth. Insolation and daytime cloudiness are used to determine atmospheric stability classification.

PLUME HEIGHT - The elevation of equilibrium that an exhausted continuous stream of heated gas or pollutants reaches (effluent from a stack or "plume"). Plume height is equal to the physical height of the smokestack plus any additional height the plume rises due to buoyancy and exit momentum.

CHAPTER 8

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THE AIR QUALITY IMPACT OF ON-SITE POWER GENERATION AS AN ALTERNATIVE FOR THE HALL PROJECT

(Alternative 4, No Action)

February 1980

Prepared by

ENVIRONMENTAL RESEARCH & TECHNOLOGY, INC.
Westlake Village, California 91361

TABLE OF CONTENTS

1. INTRODUCTION

The Anaconda Company plans the development of a molybdenum mine and concentrating facility near Tonopah, Nevada. Assessments of the air quality effects which may result from the project have previously been conducted in support of State of Nevada and U.S. Environmental Protection Agency (EPA) permit applications, prepared by Environmental Research & Technology, Inc. (ERT 1978). Subsequent to these studies, it was determined necessary to prepare an Environmental Impact Statement (EIS) for the project. A project alternative identified in the EIS but not investigated during the earlier studies is the on-site generation of power by a system of diesel-powered generators. Since this alternative has the potential to increase emissions of several pollutants over the levels used in the earlier studies, an additional air quality analysis was conducted. This report documents this additional analysis.

The current study differs in two important ways from the earlier studies:

- There are four pollutants of concern in the current work: sulfur dioxide (SO_2), nitrogen oxides (NO_x), carbon monoxide (CO) and total suspended particulates (TSP). The earlier work investigated TSP only.
- On-site meteorological measurements were not available for use in the earlier assessments. Such data were available for the current study.

As in the earlier work, the primary tool for the assessment of air quality effects is an air quality model used to estimate ground-level concentrations which are expected to result from a given level of emissions. The air quality model used in both the earlier studies and the current study is ERT's Point Source Diffusion Model (PSDM). The model is a single-source Gaussian-plume model.

This report begins by discussing the source of emissions and the emission rates. This is followed by a discussion of the meteorological variables used in the modeling. Finally, the model results are presented

and compared to federal and state standards for pollutant concentrations. Model results are also compared to allowable increments by which any one source may increase ambient pollution levels as defined under the EPA's Prevention of Significant Deterioration (PSD) legislation.

2. SOURCE DESCRIPTION

2.1 Diesel Generator System

The project alternative being examined in this analysis is the generation of power by on-site diesel generators. A total of 24 megawatts (MW) will be provided by six 4-MW units which would be installed if this option were to be selected. The units would burn ordinary diesel fuel. It is estimated that such units are capable of converting 38% of the input diesel fuel energy into power (Perry 1963). Thus, to generate 24 MW, it would be necessary to utilize 216 x 10^6 Btu/hr of fuel energy (approximately 12,000 lb of diesel fuel per hour).

The exhaust gases from these units will be vented to the atmosphere from six closely-spaced stacks. Each of the stacks will be approximately 40 feet high. The exhaust gases will contain a certain amount of waste heat from the combustion. It is estimated that roughly 30% of the input heat is released with the exhaust gases (Perry 1963). Thus, each stack will emit roughly 10.8 x 10^6 Btu/hr of heat.

2.2 Pollutant Emissions

The generators are expected to emit significant quantities of four major pollutants: SO_2, NO_x, CO and particulate matter. The emission rate of each of these pollutants has been estimated using emission factors (ERT 1979) and is shown in Table 2-1. It will be noted that both an annual-average emission rate and a maximum short-term emission rate has been specified. This is necessary since air quality standards exist for both short-term concentrations and annual-average concentrations.

2.3 Stack Characteristics

Other than emission rate, the only parameters of interest in the current modeling study are those that influence the height of the plume above ground. This height consists of two components: the height of the stack and the plume rise imparted to the emissions. Although there

TABLE 2-1

EMISSIONS FROM SIX 4-MW DIESEL-POWERED GENERATORS
AS A PROJECT ALTERNATIVE TO THE HALL MOLYBDENUM PROJECT

Pollutant	Emission Rate Grams/sec	Emission Rate Tons/year*
Carbon Monoxide (CO)	16.1	446.5
Oxides of Nitrogen (NO_x)**	115.3	3204.4
Sulfur Dioxide (SO_2)†	18.8	519.0
Particulates	2.0	55.6

*These emission rates assume an 80% annual-average capacity factor.

**Nitrogen dioxide (NO_2 emissions can be estimated by assuming they are 5% of the total NO_x emissions.

†These emissions assume that the diesel fuel contains 0.5% sulfur. SO_2 emissions from diesel fuel containing a different amount of sulfur can be calculated by simple ratioing, assuming linear increase or decrease.

are six separate stacks, the model utilized in this study treats the emissions as originating from a single point with one set of conditions. Thus, a single stack of 40 feet in height was assumed here.

The plume rise calculation used by the model is that of Briggs 1970. It requires only the specification of the amount of heat imparted to the exhaust gases to calculate the plume rise. For this study, we have assumed this heat value to be equivalent to the heat from one of the stacks (10.8×10^6 Btu/hr). This is a conservative assumption in that it will produce a lower plume rise and thus higher ground-level concentrations than if all six stacks were combined to give an "effective" heat rate. The plume rise resulting from a heat value of 10.8×10^6 Btu/hr is roughly equivalent to that of a stack 5 feet in diameter with an exit velocity of 50 ft/sec and an exit temperature of 300°F. These values are presented for comparative purposes only and are not intended to be design parameters. Actual design parameters were not necessary for the current study, thus such data were not developed.

are all separate stacks, the model utilized in this study treats the emissions as originating from a single point with summed emission conditions. Thus, a single stack of 60 feet in height was assumed here.

The plume rise calculation used by the model is that of Briggs (1970). It requires only the specification of the amount of heat imparted to the exhaust gases to calculate the plume rise. For this study, we have assumed this heat value to be equivalent to the heat from one of the stacks (10.5×10^6 Btu/hr). This is a conservative assumption in that it will produce a lower plume rise and thus higher ground-level concentrations, than if all six stacks were combined to give an "aggregate" heat rate. The plume rise resulting from a heat value of 10.5×10^6 Btu/hr is roughly equivalent to that of a 4-ft stack in diameter with an exit velocity of 50 ft/sec and an exit temperature of 300°F. These values are presented for comparative purposes only and are not intended to be design parameters. Actual design parameters were not necessary for the current study, thus such data were not developed.

3. METEOROLOGICAL PARAMETERS

The meteorology of the Hall Project site has been discussed in the earlier permit applications prepared for Anaconda by ERT. However, since those documents were prepared, considerable data has been obtained from the meteorological monitoring network currently operating on-site. For greater accuracy, this analysis has utilized the new data rather than the approach taken earlier, which was to utilize data taken at the Tonopah Airport located in the Ralston Valley to the south and east of the Hall site. The meteorological monitoring network has been described in detail in the monitoring plan previously prepared for the EPA. It consists of four stations, called north, south, east and west. For the current study, the data collected at the east site was judged to be most representative for the conditions to which the diesel generator emissions will be exposed. The selection of this data is based on the closeness of the east monitoring site to the most likely location of the diesel generators.

3.1 Annual Meteorology

For the current study, it was necessary to provide the model with a stability wind rose, an annual distribution of the frequency of occurrence of each of 16 wind direction classes, 6 wind speed classes and 5 atmospheric stability classes. While such information was available for the wind speed and wind direction classes, there were no measurements carried out on-site that would allow estimation of atmospheric stability. As a result, the statistical distribution of stabilities measured at the Tonopah Airport was used to divide the on-site data into stability classes. The stability wind rose thus developed is shown in Table 3-1.

3.2 Worst-Case Short-Term Meteorological Conditions

In the previous studies, the only short-term period considered was the 24-hour period that would produce the highest concentrations. The approach used in those studies was to consider the possibility of 8 hours of persistent conditions from any direction, calculate a sector-average concentration for that set of conditions, and divide by 3 to get a 24-hour average concentration. In each direction, all wind speed

TABLE 3-1

STABILITY WIND ROSE FOR THE HALL SITE

STABILITY CLASS 1

WIND DIR	WIND SPEED 1.2	3.5	5.5	7.5	9.5	11.5
1	.00101	.00062	.00000	.00000	.00000	.00000
2	.00327	.00030	.00000	.00000	.00000	.00000
3	.00189	.00045	.00000	.00000	.00000	.00000
4	.00352	.00039	.00000	.00000	.00000	.00000
5	.00793	.00065	.00000	.00000	.00000	.00000
6	.00264	.00028	.00000	.00000	.00000	.00000
7	.00113	.00041	.00000	.00000	.00000	.00000
8	.00151	.00045	.00000	.00000	.00000	.00000
9	.00126	.00041	.00000	.00000	.00000	.00000
10	.00151	.00043	.00000	.00000	.00000	.00000
11	.00126	.00030	.00000	.00000	.00000	.00000
12	.00239	.00041	.00000	.00000	.00000	.00000
13	.00453	.00041	.00000	.00000	.00000	.00000
14	.00252	.00037	.00000	.00000	.00000	.00000
15	.00113	.00039	.00000	.00000	.00000	.00000
16	.00176	.00062	.00000	.00000	.00000	.00000

STABILITY CLASS 2

WIND DIR	WIND SPEED 1.2	3.5	5.5	7.5	9.5	11.5
1	.00157	.00294	.00078	.00000	.00000	.00000
2	.00512	.00375	.00063	.00000	.00000	.00000
3	.00295	.00213	.00092	.00000	.00000	.00000
4	.00551	.00182	.00054	.00000	.00000	.00000
5	.01240	.00304	.00015	.00000	.00000	.00000
6	.00413	.00132	.00015	.00000	.00000	.00000
7	.00177	.00193	.00049	.00000	.00000	.00000
8	.00236	.00213	.00136	.00000	.00000	.00000
9	.00197	.00193	.00102	.00000	.00000	.00000
10	.00236	.00203	.00054	.00000	.00000	.00000
11	.00197	.00142	.00015	.00000	.00000	.00000
12	.00374	.00193	.00010	.00000	.00000	.00000
13	.00708	.00193	.00015	.00000	.00000	.00000
14	.00394	.00172	.00039	.00000	.00000	.00000
15	.00177	.00182	.00054	.00000	.00000	.00000
16	.00275	.00294	.00092	.00000	.00000	.00000

TABLE 3-1 (Continued)

STABILITY CLASS 3

	WIND SPEED					
WIND DIR	1.2	3.5	5.5	7.5	9.5	11.5
1	.00055	.00387	.00301	.00038	.00006	.00000
2	.00178	.00494	.00244	.00061	.00012	.00000
3	.00103	.00280	.00357	.00106	.00031	.00000
4	.00191	.00240	.00207	.00099	.00012	.00000
5	.00431	.00400	.00056	.00008	.00006	.00000
6	.00144	.00173	.00056	.00008	.00000	.00000
7	.00062	.00253	.00188	.00030	.00012	.00009
8	.00082	.00280	.00526	.00137	.00050	.00045
9	.00068	.00253	.00395	.00152	.00044	.00037
10	.00082	.00267	.00207	.00053	.00006	.00009
11	.00068	.00187	.00056	.00008	.00000	.00000
12	.00130	.00253	.00038	.00008	.00000	.00000
13	.00246	.00253	.00056	.00008	.00006	.00000
14	.00137	.00227	.00150	.00023	.00000	.00000
15	.00062	.00240	.00207	.00068	.00025	.00009
16	.00096	.00387	.00357	.00053	.00025	.00009

STABILITY CLASS 4

	WIND SPEED					
WIND DIR	1.2	3.5	5.5	7.5	9.5	11.5
1	.00070	.00304	.00494	.00462	.00094	.00000
2	.00228	.00387	.00402	.00739	.00188	.00000
3	.00131	.00220	.00536	.01294	.00469	.00000
4	.00245	.00188	.00340	.01201	.00188	.00000
5	.00551	.00314	.00093	.00092	.00094	.00000
6	.00184	.00136	.00093	.00092	.00000	.00000
7	.00079	.00199	.00309	.00370	.00188	.00091
8	.00105	.00220	.00865	.01663	.00750	.00454
9	.00088	.00199	.00649	.01848	.00656	.00363
10	.00105	.00209	.00340	.00647	.00094	.00091
11	.00088	.00147	.00093	.00092	.00000	.00000
12	.00166	.00199	.00062	.00092	.00000	.00000
13	.00315	.00199	.00093	.00092	.00094	.00000
14	.00175	.00178	.00247	.00277	.00000	.00000
15	.00079	.00188	.00340	.00832	.00375	.00091
16	.00123	.00304	.00587	.00647	.00375	.00091

TABLE 3-1 (Continued)

STABILITY CLASS 5

WIND DIR	WIND SPEED 1.2	3.5	5.5	7.5	9.5	11.5
1	.00417	.01853	.00727	.00000	.00000	.00000
2	.01356	.02364	.00591	.00000	.00000	.00000
3	.00782	.01342	.00863	.00000	.00000	.00000
4	.01460	.01150	.00500	.00000	.00000	.00000
5	.03286	.01917	.00136	.00000	.00000	.00000
6	.01095	.00831	.00136	.00000	.00000	.00000
7	.00469	.01214	.00454	.00000	.00000	.00000
8	.00626	.01342	.01272	.00000	.00000	.00000
9	.00522	.01214	.00954	.00000	.00000	.00000
10	.00626	.01278	.00500	.00000	.00000	.00000
11	.00522	.00895	.00136	.00000	.00000	.00000
12	.00991	.01214	.00091	.00000	.00000	.00000
13	.01878	.01214	.00136	.00000	.00000	.00000
14	.01043	.01086	.00364	.00000	.00000	.00000
15	.00469	.01150	.00500	.00000	.00000	.00000
16	.00730	.01853	.00863	.00000	.00000	.00000

classes and stability classes were examined, and the conditions which produced the highest concentrations were selected. The one exception was that, where the terrain significantly increased in height with downwind distance, stable cases were ruled out.

The current study followed the same analysis; however, certain additions were necessary. First, it was necessary to consider averaging times other than 24 hours; we also addressed 8-hour, 3-hour and 1-hour maximum concentrations. For these studies, all possible conditions were considered. It was assumed that any combination of wind speed, wind direction and stability could persist for as long as 8 hours. For each case, a 1-hour sector average concentration was calculated and assumed to be equal to the 1-hour, 3-hour or 8-hour concentration. For the 24-hour maximum study, two "worst cases" were examined in addition to the possibility of 8 hours of persistent wind from any direction, as in the previous studies. These cases were identified by examination of the on-site data and are shown in Table 3-2.

TABLE 3-2

WORST-CAST 24-HOUR METEOROLOGICAL SCENARIOS

	Scenario 1			Scenario 2		
Hour	Wind Direction	Wind Speed (m/sec)	Stability	Wind Direction	Wind Speed (m/sec)	Stability
1	E	1.2	Stable	NNW	1.2	Stable
2	E	1.2	Stable	NNW	1.2	Stable
3	E	1.2	Stable	NNW	1.2	Stable
4	E	1.2	Stable	NNW	1.2	Stable
5	E	1.2	Stable	NNW	1.2	Stable
6	E	1.2	Stable	NNW	1.2	Stable
7	W	3.5	Neutral	NNW	1.2	Neutral
8	W	3.5	Neutral	NNW	1.2	Neutral
9	W	3.5	Neutral	NNW	3.5	Neutral
10	W	3.5	Neutral	NNW	3.5	Neutral
11	W	3.5	Neutral	NNW	3.5	Neutral
12	W	3.5	Neutral	NNW	3.5	Neutral
13	W	5.5	Neutral	NNW	3.5	Neutral
14	W	5.5	Neutral	NNW	3.5	Neutral
15	W	5.5	Neutral	NNW	3.5	Neutral
16	W	5.5	Neutral	NNW	3.5	Neutral
17	W	5.5	Neutral	NNW	3.5	Neutral
18	W	5.5	Neutral	NNW	3.5	Neutral
19	E	1.2	Stable	NW	1.2	Stable
20	E	1.2	Stable	NW	1.2	Stable
21	E	1.2	Stable	NW	1.2	Stable
22	E	1.2	Stable	NW	1.2	Stable
23	E	1.2	Stable	NW	1.2	Stable
24	E	1.2	Stable	NW	1.2	Stable

4. AIR QUALITY MODELING

As in the earlier work, air quality modeling was carried out with PSDM to calculate ground-level concentrations. The model has been described in detail in the earlier documents and will not be described here. Modeling is performed to determine the impact a proposed source will have and, in particular, to compare the predicted ground-level concentrations with published state and federal standards. In addition to the standards, the Federal Government has established maximum allowable increments which limit the amount of increase in ground-level concentration any single source may contribute. The standards and increments of concern in the current study are shown in Table 4-1.

Also shown in Table 4-1 are the model predictions for each of the cases studied. For the short-term concentrations, the highest value calculated in all of the cases considered is shown in the table. Further detail on the maximum 24-hour concentrations is shown in Table 4-2.

In order for the model predictions to be properly compared to a standard, it is necessary to add in the contribution from the current background at the site as well as contributions from other Hall Project operations. Because of the remote location of the site and the absence of other industry in the area, the background concentrations for SO_2, NO_x and CO are all considered to be zero. However, there is some natural wind-blown dust which may contribute to a background TSP concentration. The on-site monitoring network measured a combined annual geometric mean TSP concentration of 16.1 $\mu g/m^3$ (micrograms per cubic meter). Although other pollutants are not produced by other Hall Project sources, for TSP, it is also necessary to add in the contribution from the other particulate-producing operations at the site. The previous studies indicated that the maximum annual-average concentration would be 5.9 $\mu g/m^3$. Maximum 24-hour concentrations were predicted to be 31.4 $\mu g/m^3$, but were not expected to occur under the same conditions as the maximum concentrations predicted for the diesel generators. The previously analyzed case that resulted in the concentration of 31.4 $\mu g/m^3$ was an 8-hour persistence

TABLE 4-1

A COMPARISON OF FEDERAL AND STATE STANDARDS AND PSD INCREMENTS WITH MODEL PREDICTIONS ($\mu g/m^3$)[a]

Pollutant	Averaging Time	Federal Standards Primary	Federal Standards Secondary	State Standards	PSD Increments	Model Predictions	Background	Other Hall Project	Total
SO_2	Annual	80		60	220	1.1	0	0	1.1
	24-hour	365		260	91	68.7[c]	0	0	68.7
	3-hour	-	1300	1300	512	151	0	0	151
TSP	Annual	75	60	60	19	0.1	16.1	5.9	22.1
	24-hour	260	150	150	37	7.3[c]	-[d]	31.4[e]	-
CO	8-hour	10,000	-	6,670[b]	-	129	0	0	129
	1-hour	4,000	-	40,000	-	129	0	0	129
NO_2	Annual	100	-	100	-	7.1[f]	0	0	7..

a. $\mu g/m^3$ - micrograms per meter cubed.
b. Above 5,000 ft MSL.
c. Resulted from worst-case 1, see Table 4-2 for other cases.
d. Not specified since worst-case for modeling is not necessarily worst-case background.
e. The highest value for other Hall Project sources did not occur with same conditions used in the current modeling. As a result, it is not possible to add the model prediction for the diesel generators to the value shown for other Hall Project to determine increment consumption. For the conditions which produced the highest other Hall Project concentrations, the value for the diesel generators is 2.9 $\mu g/m^3$. Thus, the total is still less than the PSD increment of 37 $\mu g/m^3$.
f. This results from assuming all the NO_x is NO_2

TABLE 4-2

CONCENTRATIONS FOR MAXIMUM 24-HOUR CASES

Case	Maximum SO_2 Concentration ($\mu g/m^3$)	Maximum TSP Concentration ($\mu g/m^3$)
Worst Case 1	68.7	7.3
Worst Case 2	29.3	3.1
8-Hour Persistences		
N	15.3	1.6
NNE	9.6	1.0
NE	5.8	0.6
ENE	5.8	0.6
E	5.8	0.6
ESE	5.8	0.6
SE	7.5	0.8
SSE	12.3	1.3
S	15.3	1.6
SSW	27.7	2.9
SW	50.2	5.3
WSW	50.2	5.3
W	50.2	5.3
WNW	39.6	4.2
NW	31.3	3.3
NNW	26.8	2.9

of south-southwesterly wind. For these sage conditions the diesel generators produce only 2.9 $\mu g/m^3$. As a result, concentrations of particulates produced by the diesel generators are not expected to be exceed standards or increments.

Finally, examination of Table 4-1 indicates that no standards or PSD increments are predicted to be exceeded for any of the pollutants.

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